

**Integrating Climate Change Adaptation and Mitigation in
Development Planning:
National Science - Policy Dialogue in Tanzania**

POST DIALOGUE REPORT



**20th to 22nd January 2010
Kunduchi Beach Hotel, Dar es Salaam, Tanzania**

Organized by the Pan African START Secretariat (PASS), Institute of Resource Assessment (IRA), University of Dar es Salaam

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Introduction

Africa is identified by the IPCC as one of the regions most vulnerable to climate variability and climate change due to multiple stresses and low adaptive capacity. Projected impacts in Africa include increased water stress that would negatively impact livelihoods and access to water; reduced agricultural yields, growing season length, and area suitable for crop agriculture, which would adversely affect food security and exacerbate malnutrition; decreased freshwater fisheries; and impacts of sea level rise on large populations in coastal areas. Particularly vulnerable are semi-arid and arid areas of East and West Africa.

International dialogues in various forums such as the UNFCCC, the G-8, the African Union and others highlight the growing recognition that climate change poses substantial risks to the environment, human wellbeing and future development. Both mitigation and adaptation actions are needed to reduce climate change risks to livelihoods, water security, food security, ecosystem goods and services, human wellbeing, development prospects and poverty reduction. It is now commonly recommended that, to be effective, mitigation and adaptation actions must be integrated with broader development and poverty reduction strategies and plans. Integration is needed to provide for more sustainable development that is based on environmentally sound principles and that avoids mal-adaptations in infrastructure, agricultural, industrial and social investments.

It is against this background that the project *Understanding the Findings of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report, Climate Change 2007- Integrating Climate Change Adaptation and Mitigation in Development Planning* was designed. National-level dialogues aimed at addressing the need for better communication at the science-policy interface on issues related to climate change are a key aspect of this project. Over the course of this project, nine national-level science-policy dialogues will be convened. The first of these dialogues was held in Accra, Ghana in October 2009, with the second one being in Tanzania in January 2010. This programme, *Integrating Climate Change Adaptation and Mitigation in Development Planning for Tanzania*, was held at Kunduchi Beach Hotel, Dar es Salaam. See Annex 1 for a list of the participants who attended the event.

The science-policy dialogue sought to engage the science and policy communities in identifying climate change risks and means for better communicating these risks to the public, as well as to identify options for adaptation and mitigation of climate change and policy processes that would be needed for implementing these various options. By involving national experts as well as AR4 authors, the dialogue was able to integrate the best available scientific knowledge from the IPCC *Climate Change 2007* report with national and regional knowledge sources into policy processes and decision-making. This post-dialogue report provides a synthesis of the presentations and discussions around these presentations. It also highlights critical science and policy issues that emerged from the dialogue.

Tanzania National Science-Policy Dialogue

Opening session: The dialogue commenced with an address by Professor Pius Yanda, Director of the Institute of Resource Assessment at the University of Dar es Salaam, and Director of the Pan-African START Secretariat (PASS). His introductory remarks were followed by a brief address by the UNFCC Focal Point in Tanzania, Mr. Richard Muyugi from the Vice President's Office in the Division of Environment. Ambassador Tim Clark, the EU representative in Tanzania then followed with a brief address that highlighted the critical role that the European Union is playing in advancing climate change research in developing countries, including through the new EU initiative on Global Climate Change Adaptation, of which Tanzania is one of the pilot countries. Following his address, Dr Hassan Virji, Director of the International START Secretariat spoke on behalf of START as well as on behalf of UNEP and the IPCC. Dr Virji highlighted the global concern regarding changes in climate that are threatening to transform the livelihoods of the vulnerable countries and communities and emphasized the importance of programmes such as the science - policy dialogue. His speech was followed by an address from the Deputy Vice Chancellor of the University of Dar es Salaam, Professor Yunus Mgaya who described the important role that higher education plays in helping to produce a better-informed public. The opening of the workshop by the Minister of State (Environment) in the Vice President's Office, Dr. Batilda Burian, followed thereafter. The Honourable Minister highlighted that her office, with support from government, is committed to leading and taking part in initiatives that address the challenges that climate change poses to Tanzania. Before participants broke off briefly, a Climate Witness film on impacts in Tanzania was shown.

The entire programme consisted of eight sessions that focused on issues such as modelling and climate change scenarios, climate change impacts on health, agriculture, water, coastal zones and urban areas, as well as issues related to land use change and forestry, ecosystems and biodiversity. These presentations are highlighted in Table 1. Each presentation was followed by a brief presentation from a discussant whose role was to highlight the key issues emerging from the main presentation but based on the Tanzanian experience.

Table 1: Presentation for the Tanzania national science-policy dialogue

Presenter	Topic	Discussant
Fred Semazzi	Climate Change Scenarios, Modelling	Emmanuel Mpeta
Pius Yanda	Climate Change Impacts On Agriculture	Richard Kangalawe
Andrew Githeko	Climate Change Impacts On Health	Richard Kangalawe
Emma Liwenga	Climate Change Impacts On Urban Areas	Euster Kibona
Elnour Elsiddig	Land Use, Land Use Change And Forestry	Pius Yanda
Pius Yanda	Ecosystems and Biodiversity	Elikana Kalumanga
Joseph Alcamo	Climate Change Impacts On Water	Patrick Valimba
Chris Gordon	Climate Change Impacts On	Alfred Muzuka

Coastal Zones

Session 1: Climate change scenarios, modelling

Presenter: Fred Semazzi

The presenter began by providing a description of the IPCC process i.e., how it was established, its aims, and the IPCC strategy under its three working groups which deal separately on the physical science basis, impacts, adaptation and vulnerability, and mitigation of climate change. Drivers of climate change from both natural and anthropogenic sources were highlighted. Professor Semazzi further highlighted observed climate changes in temperature and precipitation. He explained what climate models are and to what extent they can be relied on, with specific examples on regional climate change projections for East Africa. In his conclusions, Professor Semazzi highlighted that since the IPCC Third Assessment Report, consensus has evolved with *very high confidence* that warming of the climate system is unequivocal, warming trends of the last half century is unusual in at least the previous 1300 years and that there is also confidence in changes in wind patterns, precipitation, and some aspects of extreme events. He also explained that the capability of regional climate models to provide greater geographical details of projected regional climate change for the impacts community has improved substantially in recent years.

Discussant: Emmanuel Mpeta

In his response, Dr. Mpeta highlighted the trends in climate variability and change in Tanzania. While the extreme maximum temperature has increased in recent years, there is no clear change in the rainfall variability at most stations. However, highest 24 hour rainfall records are on the increase. Observed impacts due to changes in temperature indicate severe and recurrent droughts, an extreme drop of water levels of Lake Victoria, Tanganyika, and Jipe and the dramatic recession of 7 km of Lake Rukwa in about 50 years. In addition, Dr Mpeta stated that 80% of the glacier on Mount Kilimanjaro has been lost since 1912. The presentation further highlighted the fact that in other East African countries there has been an increase in the frequency and severity of drought events, an increase in the magnitude of flood events and changes in the onset and cessation of the rainy seasons. He added that as a result food production has been affected and changes in a variety of ecosystems are already being detected at a faster rate than anticipated. Dr. Mpeta also described how key determinants of vulnerability in Tanzania are associated with high dependence on rain-fed agriculture, weak institutions and pervasive poverty, among other factors. He highlighted on-going and recent project initiatives on adaptation. Critical capacity and knowledge gaps occur with respect to observation instruments and equipment and human capacity in numerical modelling.

Discussion

The discussion centered on the level of accuracy in climate change projections, and of the need for better regional downscaled models at high spatial resolution. The main challenge was identified as that of validating the models based on the actual situation on the ground. In addition, an increase in observation networks is crucial for model validation. Professor Semazzi further highlighted the observed decadal variability mode over East Africa, where in every ten years there is alternation in the wet and dry conditions between Tanzania and Kenya.

Session 2: Climate change impacts on agriculture

Presenter: Pius Yanda

This presentation covered highlights by the IPCC that climate change will result in greater incidence and severity of extreme events such as droughts and floods, which will in turn impact water resources and crop and livestock production. Projections indicate that in Southern Africa and other parts of the Horn of Africa, there will be reduced rainfall, reduced water resources and reduced area suitable to agriculture. Crop failure and livestock mortality were highlighted as major impacts of these changes. Professor Yanda explained that responses to crop yields vary depending on factors such as crop type, soil management, and other locational conditions. Increased proliferation of pests and incidence of pest attacks was also mentioned as an impact of changes in climate. Reduced yields will have consequences on food security, which will also be more affected by climate change related price increases. Projections also indicate reduced fisheries resources from lakes due to rising temperatures. A critical point highlighted in this presentation is that climate change exacerbates already existing factors which range from a heavy dependence on rainfed agriculture in Africa to population increase and a decline in public spending on agriculture, related research and development assistance. Issues of limited agricultural mechanisation and poor road infrastructure were also highlighted.

Professor Yanda described how vulnerability to these climate changes differs due to different levels of adaptive capacity. Africa is most vulnerable because communities depend on agriculture, have low technology and are exposed to multiple stresses. At the local level, different social groups such as men and women are affected differently because of unequal power relations and differential access to resources. The presentation also touched on response measures such as expansion of food production in wetland areas and migration to resource rich areas, though there are tradeoffs in terms of potential negative impacts on ecosystems with such a strategy, and change of crop varieties and types. Other response measures included diversification of livelihood opportunities and rainwater harvesting

Discussant: Richard Kangalawe

This presentation highlighted how reduced growing seasons have implications on various crops. Increased temperature affects crops differently in different agro-ecological conditions. While there may be a disadvantageous shift in agro-ecological conditions for some crops there may be an advantage to crops that were not doing well under current climatic conditions. Pastures may also become scarce with increased temperatures, which may also cause reduced production and increased pests and disease pressure on both livestock and crops. In his response Dr. Kangalawe also highlighted that an increase in rainfall may lead to more demand for supplementary nutrients from the same unit. If not well managed, there may be soil erosion and deterioration of soil conditions and infrastructure may be damaged. However, in some places where areas were drier, that may lead to increased and better production. He also added that in responding to climate changes, wetlands are refugee areas in situations where uplands are not doing well and

ensure food security during the year although this may have considerable adverse effects such as excessive drainage of nutrients.

Discussion

The discussion centred on a range of issues. These included:

- How policy ignores sectors like forestry and others that are equally important for food security and instead focus on agriculture alone when dealing with climate change;
- The need to focus on farmer adaptation to increased pests and diseases from climate change, as distinct from climate variability;
- The issue of making rainfall data more available to farmers and supporting institutions at the local level.
- The need to establish and strengthen response strategies that are not detrimental to farmers' food security was also emphasised; for example, migration was considered to have negative effects on farmers' food security.

In the context of this discussion, adaptation is to be viewed as a combination of strategies as opposed to single activities carried out by farmers. In addition, it was highlighted that there is a need to move beyond food production only in to developing sound policies for food pricing/markets and transportation as well.

Session 3: Climate change impacts on health

Presenter: Andrew Githeko

Dr. Githeko highlighted the elements of health that are affected by climate change, such as food-borne contaminants, safe drinking water, vector-borne diseases and cardiovascular diseases, and the specific diseases under each category. Dr. Githeko described how the quantity and quality of safe drinking water will be affected by prolonged droughts, the melting of glaciers, and flooding, and how under-nutrition and malnutrition could increase as a result of food shortages and increased costs. The presentation also highlighted the hazards such as storms, heat-waves, floods and landslides, which are set to increase in incidence. The speaker further highlighted that there are other drivers of food and water borne diseases, which include poverty and poor hygiene and hot and humid weather. Lastly, the presentation touched on adaptation options for responding to these changes, which include an increase in irrigation, use of safe drinking water technologies and hygiene, and improved preparation and storage of food. Vaccinations and increased control against vectors was also emphasized.

Discussant: Richard Kangalawe

Dr. Kangalawe's response centered on impacts to both the natural and social systems. He highlighted how an increase in extreme events will in turn increase health hazards related to infectious diseases and climatically suitable areas for malaria, using examples from a case study of Tanzania. He highlighted increased risk of malaria in the East African highlands in what have been previously malaria-free areas. The speaker also stressed that impacts of climate changes may also interact with other stresses and additional

vulnerabilities such as HIV/AIDS, resulting in increased susceptibility and risk of other infectious diseases (e.g., cholera) and malnutrition. Animal health was also considered to be under threat from climate change. For instance, heat stress and drought are likely to further negatively impact animal health and production of dairy products. His presentation also highlighted adaptation measures such as the national malaria control programme, and ongoing and recent studies and initiatives on climate change and health. These projects include capacity building to evaluate and adapt to climate change-induced vulnerability to malaria and cholera in the Lake Victoria Region, East Africa, Climate Human Environment Interactions in Africa, The African Climate Change Fellowship Program, which supports work on modelling changes in malaria incidence with climate change, a project on strengthening national capacity to adapt to the adverse impacts of climate change and one on strategies for addressing negative effects of climate change in food insecure areas in Tanzania. Most of these projects have been implemented by the Institute of Resource Assessment at the University of Dar es Salaam in collaboration with other institutions in and outside the country.

Discussion

The discussion focused on issues concerning communities living in rural areas, which is a large percentage of Tanzania, as being the most susceptible to climate change, especially in the context of health. It was highlighted that a large percentage of those living in rural areas have limited access to health services; hence they rely on herbs for traditional medicine. In this respect, climate change, among other factors, is contributing to the disappearance of those herbs, leaving people, domestic animals and wild animals vulnerable to diseases, which could be treated easily by such herbs. The question posed henceforth was; how can we consider these kinds of impacts when developing adaptive measures to climate change? A recommendation given in this regard was related to the need to increase awareness of climate change among health stakeholders and to establish a tropical diseases centre. The other area of discussion concerned how to prioritize, from the perspective of the medical/public health community, in order to determine what the most cost effective policies would be first, i.e. to establish and improve public health facilities such as hospitals and dispensaries infrastructure or to promote interventions such as the use of treated bed nets to prevent malaria.

Session 4: Climate change impacts on urban areas

Presenter: Emma Liwenga

This presentation provided a situational analysis for urban areas. The fact that urban areas in low and middle-income nations are home to more than one-third of the world's total population was highlighted. The presentation further elaborated on IPCC findings which underline the vulnerability of cities to climate change and subsequent extreme events. Direct and indirect impacts from extreme events in cities were explained in detail. Dr. Liwenga highlighted that climate change impacts in rural areas affect urban dwellers for instance through migration to cities, which have not been planned with rapid increases of population in mind. This increases pressures in cities with estimates of migration reaching 200 million by 2050. The drivers of urban pressure were highlighted as population pressure, increase in poverty levels and other factors such as location of cities

in hazard-prone areas, lack of infrastructure and poor planning. The speaker further highlighted adaptation and mitigation measures. For example, city and municipal governments need to implement and enforce regulatory frameworks essential for public health and safety for urban planning and infrastructural development that take into account the effects of climate change. She listed projects that focus on climate change issues in urban areas in Tanzania and emphasised that these municipalities need to incorporate climate change issues into long-term city planning and address vulnerability of key sectors such as health, water and sanitation, among others.

Discussant: Euster Kibona

The respondent began by giving background information on cities in Tanzania i.e. the rapid rate of urbanization that have led to a proliferation of unplanned settlements, development and environmental management pressures and limited and no access to basic infrastructure. Vulnerabilities of cities in Tanzania were highlighted as being sea level rise, flooding, water scarcity and hydro-electricity generation. Areas in Dar es Salaam prone to floods were identified as the Msasani *bonde la mpunga* (rice basin) in Kinondoni municipal, the city centre and Msimbazi valley, which is located close to the city. Ms. Kibona stressed that sea level rise and coastal erosion are mostly felt in Kunduchi and Bahari beaches. Sectors such as transport, tourism, energy, water and fisheries are also affected. The speaker then highlighted the adaptation measures that have been undertaken to respond to environmental issues. These measures include the Master plan, 1979, Strategic Urban Development Planning Framework, (SUDPF), 1992, Kinondoni Coastal Area Management Project (KICAMP), Sustainable Coastal Communities and Ecosystems (SUCCESS) and Construction of structures, among others. Ms. Kibona also emphasised the need to revolutionise economies in cities, rebuild infrastructure and develop the political, regulatory, and financial institutions needed to track, control and price national emissions with sufficient transparency and accuracy to satisfy international standards.

Discussion

The discussion covered a range of topics, including Manifestations of poverty in urban areas, such as that which impels the urban poor to build houses in flood prone areas, and the issue of bureaucracy in acquiring plots for house construction which contributes to this problem. In addition, the discussion emphasized the need to:

- Critically analyze the role of engineers in town planning. The question posed is ‘Do engineers and architects take into account the impacts of climate change when designing buildings?’
- Promote a culture of cleanliness, which is lacking in developing country cities, ushering in the need for implementing laws prohibiting the habit of littering.
- Better address rural development problems in order to alleviate problems in urban areas.
- Develop or enhance effective planning and governance mechanisms that ensure provisioning and sustaining appropriate infrastructure
- Promote education at elementary and secondary schools aimed at instilling and improving a culture of cleanliness.

It was agreed that a central issue underpinning urban planning, with implications on the sustainability of cities like Dar es Salaam concerned how local political interests, excessive bureaucracy and corruption can impede progress resulting in situations where inadequate central or planned development has led to the rise of squatter settlements such as those found in Dar es Salaam.

Session 5: Land use, land use change and forestry

Presenter: Elnour Elsiddig

The presentation started off with highlights of needs in developing countries with regards to climate change awareness. The issue centered on the vulnerability of these countries to climate change, yet they have limited contribution to related debates. The presentation further highlighted observed and projected climate change before focusing on temperature rise and its impacts on the loss of arable and forested land and the resulting impacts on agriculture and human populations in Africa. The speaker then focused on land use and climate change with specific focus on deforestation and general forest degradation. The importance of forests as carbon sinks was highlighted. Professor Elsiddig explained the driving forces behind deforestation and forest degradation as population increase directly linked to agriculture, commercial logging and wood energy. He further suggested strategies and policies such as REDD which are aimed at reducing emissions. A lengthy discussion of REDD approaches and benefits was given in the discussant's presentation. The suggested way forward centered around developing regional strategies in developing countries based on agriculture and forest losses in relation to climate change.

Discussant: Pius Yanda

This response started off by highlighting natural ecosystems such as forests as carbon stocks. The presentation further emphasised the potentials for REDD in poverty alleviation, improving governance, conserving biodiversity and provision of other environmental services. In addition, it was stressed that REDD has the potential to deliver large cuts in emissions at a low cost within a short time frame, enhance biodiversity conservation and contribute to reducing poverty. Overall, REDD was highlighted as leading to sustainable development. However, Professor Yanda also indicated that Tanzania as a nation in the developing countries' region has several challenges for consideration. These challenges include strong linkages in socio-ecological systems, REDD based land use system changes, overlapping policies and poor law enforcement e.g in preventing illegal logging and lack of regular, reliable, specific and accurate data for computing baseline emissions. The other challenges were highlighted as poor governance, poor responses at the local level, poor formal recognition of indigenous peoples' rights and their knowledge and conflicting interests among various stakeholders in developing and implementing REDD initiatives.

Discussion

Much of the discussion was based on the key message by Prof. Elsidig gave concerning the fact that Africans should find ways of positioning themselves in the climate policy road map. The concern of many was on how African countries like Tanzania will benefit from climate change initiatives such as CDM and REDD. To many, the initiatives are too complicated for the poor to benefit. The poor mostly depend on the forests for their livelihoods on daily basis. Thus, such initiatives should consider the issue of crop production/food security and generally be pro-poor. Another issue that was raised concerned conflicting goals wherein, for instance, some multinational companies are offering incentives for people to increase crop production and thus propel increased deforestation (the practical example is of tobacco production in the Miombo woodlands of Tanzania). The poor can easily be convinced to increase production at the expense of forest conservation rather than conserving forests for future benefits, of which to some the future does not seem to come. A similar sentiment was raised concerning what happened in Sudan for those who were involved in a CDM initiative. What was lastly agreed is that all these initiatives are good, but there are a number of social, cultural and political factors which need to be considered. In running REDD, the best agreed approach was market-based as opposed to fund-based. The latter was challenged, given the complexities in governing funds at the government level in most of the African countries.

Session 6: Ecosystems and biodiversity

Presenter: Pius Yanda

The presentation focused on reasons why Africa should be concerned about the impacts of global climate change on biodiversity. The major reason is that Africa is rich in biodiversity such as plants, mammals and birds. The major impacts on biodiversity were highlighted in this presentation as being at two levels; the ecosystems and species levels. Professor Yanda indicated that there have already been observed impacts on these species and ecosystems. He went on to highlight hot spots such as the Cape Floral Kingdom, the Succulent Karoo biome and other floral regions affected by global warming. These floral regions are found in Madagascar, the mountains of Cameroon, the island-like Afromontane habitats that stretch from Ethiopia to South Africa, the Albertine Rift region and Eastern Arc Mountains. This was followed by a detailed exposition of specific birds, mammals and plants that are affected by climate change. The speaker then highlighted other non-climate threats to biodiversity such as timber harvesting, fuel wood, expansion of agriculture and urbanisation. Responses to these and other threats were suggested as adopting achievable targets for emission reductions and simultaneously planning and preparing to protect human health and communities, as well as ecosystems and the services they provide.

Discussant: Elikana Kalumanga

The respondent highlighted the impacts of climate change and variability on biodiversity in Tanzania, which is one of 20 mega biodiversity countries in the world and one of 25 global biodiversity hotspots. Mr. Kalumanga also pointed out that Tanzania has centres of endemism such as Afromontane archipelago, Somali-Maasai, Zambezian, Zanzibar and Lake Victoria. The speaker also mentioned that there are important ecological zones and

ecological sensitive areas based on UNEP criteria and that all levels of biodiversity are susceptible to climate change impacts. However, he indicated that there is inadequate quantifiable data at all levels of biodiversity. Furthermore, the presentation revealed that biodiversity is affected by climate change both directly and indirectly; directly through extreme events (floods and droughts) and indirectly through accelerated non climate stressors. Mr. Kalumanga concluded that in Tanzania, there is currently a passive biodiversity management approach, which leaves 'nature to take its own course' and highlighted the need to act immediately by implementing an adaptive management approach.

Discussion

Concerns were voiced by the participants that researchers could be overplaying the role of climate change, as some of the impacts may not be from climate change but due to activities such as hunting and also due to conflicts between Kenya and Tanzania on wildlife. These conflicts are as a result of the trans-boundary nature of some of the animals. There were also suggestions for identifying areas which would make species in biodiversity vulnerable for conservation efforts and that adaptive management should be taken side by side with research to minimise loss. There were also suggestions of the need for further research to inform decision makers on the best way to take precautionary measures for ecosystems so that they can be less impacted by climate change. Further research is also needed to identify any positive impacts that may emanate from climate change. The discussion also centred around the need for more of ex-situ than in-situ management of ecosystems as outside activities have been detrimental to these ecosystems.

Session 7: Climate change impacts on water

Presenter: Joseph Alcamo

The presentation started off by listing the impacts of climate change on the water cycle. This was followed by an exposition of impacts of climate change on water resources, specifically impacts of higher temperatures and changed flow regimes on lake and river ecosystems, hydroelectricity and hot spot regions of decreasing precipitation and water availability. In addition he spoke about the likely side effects of expanded water withdrawals, such as increasing wastewater discharges and water contamination. Prof. Alcamo emphasized adapt will occur within the context of an urgency in expanding water supplies, threats of increasing water stress and threats to aquatic ecosystems; thus adaptation will have to occur at both the supply side and the demand side. Appropriate adaptation options put forth included the need to focus on demand management, to exploit decentralized, local approaches where possible, to plan for adaptation based on the best possible information and to integrate adaptation planning and measures into a holistic plan of action for river basins.

Discussant: Patrick Valimba

This respondent presented a case study of Tanzania's water resources and how they could be impacted by climate change. Dr. Valimba discussed impacts of climate change by season, presenting information on vulnerable sectors such as agriculture, fishing, forestry,

settlements and transportation. However, the speaker acknowledged that some of the impacts may not always be related entirely to climate variability and change but also to some stressors on water resources including from land cover changes. In addition, the speaker added that a thorough understanding of the Tanzanian case is hampered by limited knowledge of variations and interactions of hydrological cycle components and impacts of human activities on water resources. Other barriers to this understanding were also cited as limited human, financial and technological capacity, weak institutional arrangements and limited hydrological, climatic, hydro geological data availability.

Discussion

The discussion centered around the issue of discrepancies in models, with models on global predictions indicating that there will be an increase in precipitation yet from the Tanzania met data there are no such indications of a significant increase. Therefore, uncertainty was highlighted as the major factor that needs to be considered in interpreting model results, particularly related to precipitation projections as compared with temperature projections, for which there is more confidence. Lack of confidence in precipitation projections was identified as a hindrance for integrating adaptation planning into disaster preparedness. Reduced water availability was mentioned as indicating that there has not been an increase in precipitation. However, the panel hastened to indicate that rainfall data may not be good indicator of trends in precipitation increase/decrease since there are other issues to consider, such as increased evaporation due to increased temperatures. Understanding changes in rapid runoff patterns was noted as being key to tackling some adaptation challenges related to water and sustainable land management. The need to communicate this kind of information to policy makers to enhance their understanding on climate change issues was emphasized. For instance, wetland agriculture was highlighted as having implications on water resources management, which calls for an integrated approach in dealing with associated problems.

Session 8: Climate change impacts on coastal zones

Presenter: Chris Gordon

The presentation was based on input from a presentation given by Dr. Niang at the Ghana dialogue in October 2009. Prof. Gordon discussed major bio-physical and socio-economic impacts on coastal zones, in addition to those from climate change. A detailed picture was given of the impacts in each category. The speaker ended the presentation by explaining the adaptation options available for people living in coastal zones. These include structural and non-structural solutions, planning and management and information, communication and education. In conclusion, the speaker highlighted that climate change is a global reality and therefore adaptation is unavoidable. He further highlighted that choices made now will be crucial in the future and that management frameworks will be very important and should integrate short and long time horizons. Recommendations from this presentation highlighted the need for strengthening observation/monitoring networks and developing policies for integrated coastal zone management. Better integration of local decision makers and populations and sensitization, information and education were emphasised.

Discussant: Alfred Muzuka

The respondent reiterated main findings of the previous speaker regarding climate change impacts on coastal resources using a case study of Tanzania. Dr. Muzuka focused on coastal erosion resulting from both natural and human induced activities, and on sea level rise and how it could affect coastal resources and beaches around Dar es Salaam and other parts of the country. Sea level rise poses risks to loss of land and coastal vegetation, loss of hotels and human settlements, impacts on small islands, mangroves and coral reefs, and fisheries and aquaculture. The presentation highlighted potential adaptation measures such as construction of sea walls. However, some of these walls were said to have been erected without scientific backing, rendering them ineffective. In addition, Dr. Muzuka spoke of the need for observation stations, a need to map out mangrove areas and establish if there is room for landward migration for better prediction of their survival. The need for further studies on carbon sequestration by corals and trend in calcification and awareness by farmers on new methods in aquaculture were also emphasized.

Discussion

The whole discussion was based on adaptation costs in coastal areas. The critical question posed was; are African countries capable of adapting? Given the costs of establishing some structures to protect the effect of sea level rise, it was highlighted that there is not a single country in Africa which can afford such structures. Therefore, the best option suggested for African countries (including Tanzania) is to have collective efforts where a wide-range of experts; coastal geomorphologists, engineers, marine scientists and experts on tide dynamics sit together to develop integrated planning and advice for informing all coastal development initiatives in the country (coastal tourism development, sea weed farming, etc). The discussion also revealed that some of the non-climatic stressors (e.g. dynamite fishing, coral mining, excessive mangrove harvesting, etc need to be controlled because they exacerbate the effects of sea level rise. Lastly, it was emphasized that in order to control these and other stressors, laws need to be seriously enforced as well as planning mechanisms put in place to better coordinate integrated coastal zone management strategies.

Round table discussions

Two discussion groups were formed to develop recommendations on what needs to be done in the country in order to disseminate climate change messages to the general public, to share perspectives on how to link adaptation and mitigation to development goals and to strengthen communication at the science-policy interface. The following recommendations were made by participants of the two groups:

- ❖ ***Increasing public awareness and understanding of climate change risks and options for mitigation and adaptation***
 - Infusing awareness in schools
 - Involving village environmental committees

- Involving the media by empowering journalists in understanding climate change impacts and adaptation strategies
 - Use of Radio, TV and newspapers in disseminating climate change issues
 - Training of trainers; to train the population at the village level
 - The government should include issues of climate change in school curricular
 - Educating decision makers on climate change matters (special seminar/training sessions)
 - Involving churches, mosques and village councils to create awareness of climate change
 - Integrating climate change news in popular culture such as music and films
 - Make use of politicians to incorporate climate change issues in their campaign slogans
 - Conducting special climate change seminars for members of parliament (can be organised as evening sessions during parliament sessions)
 - Climate change needs to be put on the national agenda in a similar way as ‘Agriculture First’ ‘*KILIMO KWANZA*’
- ❖ ***Sharing perspectives on how to link adaptation and mitigation to development goals***
- There is a need for bottom-up planning, starting from the village level
 - District councils should be a focus as they are involved in preparing development plans, which are then compiled at the national level
 - There is a need for making use of higher institutions to incorporate climate change issues in most of their curricular
 - Development strategies like the National Strategy for Growth and Reduction of Poverty-*MKUKUTA* need to incorporate climate change-related issues
 - There is need to integrate climate change strategies with more centralized approaches
- ❖ ***Strengthening communication at the science-policy interface by having annual similar dialogues to discuss climate-change and development matters.***
- In most of the organized climate change fora and dialogues there is a need for having a critical mass of decision makers
 - There should be demand driven research to address national issues relevant to development and solving local problems
 - There is need for policy briefs for decision makers with the aim of updating them with research findings
 - Proposition to have an annual Climate Change Forum to share multi-sectoral experiences with scientists and policy makers

Emerging policy issues from the Tanzania national science-policy dialogue

Apart from forming a discussion platform for scientists and policy makers, this dialogue has brought to the fore the fact that there is not a single sector in the country which is immune to the impacts of climate change. Almost all of the major sectors in the country are climate-dependent and climate-sensitive, these include agriculture, fisheries, health and tourism. This has led to the realization that more needs to be done at the policy level to incorporate climate change issues and concerns in development planning for the nation. Moreover, the dialogue has served as a platform where scientists and policy makers articulated a shared and compelling vision about the inseparability of climate issues and development planning. Issues aimed at generating political will, policy reforms and funding streams necessary to address climate change matters at the national level were teased out. The following paragraphs summarize policy issues identified during the dialogue.

The dialogue revealed a number of issues that are critical in Tanzania for policy making regarding climate changes and their impacts on various sectors. It highlighted challenges such as capacity and knowledge gaps in observation instruments and equipment and human capacity in numerical modelling. Recommendations for this shortcoming centred on the need for strengthening relevant institutions such as meteorological services by ensuring that they are well equipped with the necessary equipment and human resources.

The dialogue identified policy deficiencies in Tanzania, such as the tendency of policy makers to focus on agriculture in isolation rather than as an integrated activity that should encompass the concept of food security in its entirety. Thus there is a need to also consider issues to do with marketing and the transporting of agricultural products. In the same respect, it was determined that policies regarding relevant non-agricultural sectors such as forestry be integrated with policies on agriculture and food security, rather than having them drafted as distinct policies.

In view of the climate change impacts that were identified as bedevilling the health sector in Tanzania, it was recommended that there is need for government to establish and improve public health facilities such as hospitals and dispensaries infrastructure and at the same time promote interventions such as use of treated bed nets to prevent malaria.

Given the unprecedented increase in urbanization in Tanzania, it was recommended that there is need to advance political, regulatory and financial institutions with regards to the development of infrastructure that is well suited for climate related hazards such as sea level rise and flooding in Dar es Salaam and other cities in Tanzania. In the same breath, the importance of addressing development challenges in rural areas was considered to go a long way in curbing the rampant rural-urban migration.

While the role played by REDD in mitigating the effects of emissions was acknowledged, the dialogue highlighted that Tanzania has to challenge the overlapping policies and poor

law enforcement with regards to illegal logging and lack of regular, reliable, specific and accurate data for computing baseline emissions. The conflicting interests of various stakeholders in the implementation of REDD was implicated as one of the challenges facing the REDD initiative in Tanzania. In addition, the dialogue called for the strengthening of funding systems in the implementation of REDD.

With regards to ecosystems and biodiversity, it was determined that in Tanzania there is inadequate quantifiable data at all levels of biodiversity. The fact that biodiversity is affected both directly and indirectly by climate change led to the recommendation that there is need to have an active biodiversity adaptive management approach. Moreover, the importance of commissioning further research in order to provide sufficient quantifiable data to enable informed decisions to be made was emphasised. The same applied for the need for sufficient data on hydrological systems and the impacts that emanate from changes in climate, alongside the strengthening of institutional arrangements governing water resources governance.

A critical component lacking in Tanzania in the context of the management of coastal resources is the development of integrated coastal zone management initiatives by a wide range of experts such as engineers, marine biologists and coastal geomorphologists, among other experts.

In addressing climate change in Tanzania, dialogue participants recommended the following initiatives:

- ❖ Increasing public awareness and understanding climate change risks and options for mitigation and adaptation by, among others, making use of media, creating awareness to different groups in the country, incorporating climate change in the education curricular at various levels and training of the trainers to reach the message to a wider audience.
- ❖ Sharing perspectives on how to link adaptation and mitigation to development goals by incorporating climate change matters in development planning at all levels (village, district to the national level).
- ❖ Strengthening communication at the science-policy interface by having annual similar dialogues to discuss climate-change and development matters, where a critical mass of decision/policy makers attends.

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